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IAP5 Rec'd PCT/PTO 25 JAN 2006

Response to the PCT Written Opinion

1) The following opinions were expressed in the Response dated November 2, 2004 issued by the PCT International Searching Authority.

"Documents 1 to 3 describe a perovskite oxide sputtering target as limited in present claims 1 to 3.

Document 2 describes a crystal grain size that overlaps with the average crystal grain size as limited in present claim 2.

As described in documents 4 to 8, it is ordinary practice to limit the density, purity and resistivity in an oxide sputtering target in order to improve the strength or sputtering characteristics, and there is nothing exceptional about the numerical values provided in present claims 1 to 3.

Further, as described in Document 8, to sequentially perform the steps of mixing oxide raw materials, and then subjecting this to calcination, pulverization, hot pressing, sintering and heat treatment in the manufacture of a sputtering target is something that is ordinarily performed for aiming to obtain a high density target.

Accordingly, the invention of claims 1 to 3 lacks inventive step based on Documents 1 to 8."

2) The cited documents are the following Documents 1 to 8.

Document 1:JP9-260139
Document 2:JP9-74015
Document 3:JP9-7832
Document 4:WO2001/038599
Document 5:JP01-172423
Document 6:JP10-297962
Document 7:JP9-316630
Document 8:JP9-209134

3) Foremost, the amendments are explained.

The claims of this application have been amended based on the

Amendments filed on the same date (amendments under Article 34). In other words, claims 2 and 3 were introduced to claim 1 so as to limit the scope thereof. In connection with this, redundant claims 2 and 3 were deleted. The present invention differs from the Cited Documents in many respects, and possesses inventive step. The grounds for this are explained in detail below. Incidentally, for the convenience of comparison with the Cited Documents, the amended claim 1 is once again indicated below.

"Claims

1. A sputtering target that is a perovskite oxide represented by the chemical formula of $Ra_{1-x}A_xBO_{3-\alpha}$ (wherein Ra represents a rare earth element consisting of Y, Sc and lanthanoid; A represents Ca, Mg, Ba or Sr; B represents a transition metal element such as Mn, Fe, Ni, Co or Cr; and $0<x\leqq 0.5$), wherein the relative density is 95% or more, the average crystal grain size is 100μm or less, the resistivity is 10Ωcm or less, and the purity is 3N or more.

2. (Deleted)

3. (Deleted)

4) Next, the present invention is compared with the Cited Documents.

Foremost, although the Examiner is indicating that Documents 1 to 3 describe a perovskite oxide sputtering target, the other Documents 4 to 8 do not describe a perovskite oxide sputtering target. This is a major matter.

As you are well aware, there are various types of sputtering targets to be used according to the intended purpose of the sputtered film. For instance, this would be for the use in a conducting layer, insulation film, semiconductor film, magnetic film, dielectric film and so on. Even in these fields of large films, there are various types of films according to the type of material.

Document 4 cited in the Search Report describes a target having as its principal component indium oxide and zinc oxide referred to as IZO; Document 5 describes a titanium oxide target for forming a conductive thin film; Document 6 describes a ZnO-Ga_2O_3 sputtering target for forming a conducting layer;

Document 7 describes a BaSrTi oxide sputtering target for forming a dielectric thin film; and Document 8 describes an indium sputtering target for forming a transparent conducting layer.

Needless to say, these materials have different attributes regarding density, purity, crystal grain size, resistivity and so on. Although a sputtering target is generally formed via sintering, since different substances are used, the difficulty in sintering is different, and these are hardly ever manufactured under the same conditions for the simple reason that they are targets. This is because, in addition to the composition of the materials, depending on the amount to be mixed, the characteristics thereof will change significantly.

When considering the above, Cited Documents 3 to 8 have no relevance to the perovskite oxide sputtering target of the present invention. Since the perovskite oxide represented by the chemical formula of $Ra_{1-x}A_xBO_{3-\alpha}$ (wherein Ra represents a rare earth element consisting of Y, Sc and lanthanoid; A represents Ca, Mg, Ba or Sr; B represents a transition metal element such as Mn, Fe, Ni, Co or Cr; and $0<x\leqq 0.5$) of the present invention has extremely inferior sinterability, there is no perovskite oxide having a relative density of 95% or more in conventional technology.

Although the Examiner is citing Documents 1 to 3 as examples describing a perovskite oxide target, there is no description indicating that the relative density is 95% or more. In addition, these Documents 1 to 3 do not even describe the density of the target. This is considered to be because Cited Documents 1 to 3 were not able to deal with the "high densification" of the perovskite oxide target, and gave up trying to obtain such high density target.

Originally, to improve the density of a perovskite oxide target is an extremely important matter, and, if the density is low, the target would crack easily, and, in some cases, break apart. Further, there is another problem in that the particles would increase during the deposition process, and the quality of the thin film will deteriorate. The target of this invention having a relative

density of 95% or more is able to overcome all of these problems. This is a target that could not be obtained heretofore.

With the perovskite oxide target of Cited Documents 1 to 3, as a result of the foregoing problems, deposition methods such as the laser abrasion method or ion beam sputtering method, which do not have to give consideration to the problem of target density, are used (Paragraph [0018] in Cited Document 1 describes the use of the laser abrasion method, Paragraph [0037] of Cited Document 2 describes the use of the laser abrasion method or ion beam sputtering method, and Paragraph [0017] of Cited Document 3 describes the use of the laser abrasion method). In other words, it could be said that Cited Documents 1 to 3 had no choice but to use such laser abrasion method or ion beam sputtering method for the perovskite oxide target.

The laser abrasion method and ion beam sputtering method, in comparison to ordinary sputtering (DC sputtering or RF sputtering), have numerous drawbacks in that it is difficult to deposit a large and uniform film or to control the formation of the film. Thus, the use of these methods in itself is a disadvantageous factor in the manufacturing process.

Nevertheless, the high density sputtering target of the present invention can be used in ordinary sputtering (DC sputtering or RF sputtering), and is a target to be used for this exact purpose. In other words, it can be assumed that the target of this invention and the targets described in Cited Documents 1 to 3 are substantially different targets.

Therefore, it is not possible to easily arrive at the present invention from Cited Documents 1 to 3 that do not in any way give consideration to the target density. To start with, the problem of perovskite oxide targets of conventional technology only being able to achieve low density is an issue that is beyond the scope of understanding of Cited Documents 4 to 8 that use entirely different materials. Therefore, the present invention could not have been easily devised even upon combining these Cited Documents 1 to 8.

In addition, as indicated in the claim of this invention, the average crystal grain size being 100μm or less, the resistivity being 10 Ωcm or less, and the purity being 3N or more are required as constituent elements. Among the above, only the average crystal size of Cited Document 2 is common to the above, and there are no other descriptions.

Although the Examiner is citing numerous Cited Documents 4 to 8 that use entirely different materials, when viewing the discrete characteristics of each of these materials, it is only natural for some characteristics to be the same. Still, it would be clearly erroneous to say that an invention could be devised by combining entirely different materials that have no relation to each other whatsoever. This is because an invention can only be devised with a specific purpose or objective for obtaining characteristics of that material. We are of the opinion that it would be wrongful to deny inventive step based on the grounds that the same characteristics as the present invention could be found in numerous Cited Documents 4 to 8 using entirely different materials as described above.

A different material has its own unique characteristic, and it is not something that can be realized with the perovskite oxide target. In other words, if a different material is to be used as conventional art, there must at least be some kind of roadmap that allows the assumption of facts; that is, an indication that verifies such fact or a description that suggests such fact. In reality, Cited Documents 4 to 8 do not provide any such kind of description.

Therefore, we are of the opinion that it would be erroneous to say that the invention of claim 1 could have easily been devised based on Cited Documents 1 to 8.

5) Accordingly, the invention of claim 1 of this PCT application is not something that could have been easily achieved based on the technology described in Cited Documents 1 to 8, and clearly possesses inventive step in comparison to the cited (conventional) technology.